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SUBSURFACE MICROBIAL HABITATS ON MARS

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We have developed scenarios for shallow and deep subsurface cryptic niches for microbial life on Mars. Such habitats could have considerably prolonged the persistence of life on Mars as surface conditions became increasingly inhospitable. The scenarios rely on geothermal hot spots existing below the near or deep subsurface of Mars. Recent advances in the comparatively new field of deep subsurface microbiology have revealed previously unsuspected rich aerobic and anaerobic microbial communities far below the surface of Earth. Such habitats protected from the grim surface conditions on Mars could receive warmth from below and maintain water in its liquid state. In addition, geothermally or volcanically reduced gases percolating from below through a microbiologically active zone could provide reducing power needed for a closed or semi-closed microbial ecosystem to thrive.

Sulfur is such an abundant element in the surface materials of Mars that one might expect this element to be abundant in subsurface material as well. Sulfur in its many forms should be readily available to enter into the microbial chemistry of a subsurface Martian ecosystem. To begin to substantiate the plausibility of our scenarios, we are conducting preliminary experiments on several pure cultures and samples from natural sulfureta to investigate the minimum concentrations of H_2S which can be used in various metabolic processes by these organisms.

Scenario development of possible Martian habitats of the past or present is difficult in light of our limited knowledge of the planet. Nevertheless, such development is critical for designing future robotic and human expeditions to look for extant life or traces of extinct life. The subsurface habitats we suggest are amenable to the new microbial drilling technologies being developed in the field of deep subsurface microbiological remediation of subsurface pollutants. Techniques which will recover microbiologically uncompromised deep samples for biological analysis will also provide a wealth of information for Martian geologists, hydrologists, and volcanologists to ponder.